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Christine Böckelman

Cost analysis of cloud based converged infrastructure for a small sized enterprise

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Supervisor: Prof. Heikki Hämmäinen

Instructor: Ekon. Mag. Marianne Owren

AALTO UNIVERSITY SCHOOL OF ELECTRICAL ENGINEERING	ABSTRACT OF THE MASTER’S THESIS	
Author: Christine Böckelman		
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Department of Communications and Networking		
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Supervisor: Prof. Heikki Hämmäinen		
Advisor: Ekon. Mag. Marianne Owren		
<p>The purpose of this thesis is to study the dispersed IT architecture of a small sized enterprise versus a converged cloud based IT architecture. Cloud computing enables moving to a pay-as-you-go model with low up-front investment making it attractive to small sized enterprises. Other traits that appeal to small sized enterprises are flexibility, modularity and ease of use. However, an important factor to be aware of when investing in a cloud solution is hidden costs, such as extra fees and premium support costs.</p> <p>The two scenarios (dispersed versus converged) are studied in terms of Total Cost of Ownership (TCO) and Customer-Provider Strategic Alignment Maturity (CPSAM) as the IT services are outsourced in both scenarios. The TCO provides cost information on both scenarios indicating where savings could be made and exposes excess expenditures. Whilst the CPSAM studies the outsourcing strategies and unveils vendor management issues.</p> <p>Based on the analysis the main differences in TCO related to operational costs, which includes maintenance and support costs. These can vary, however taking in consideration a margin of error there was still a clear difference between the two scenarios and the converged architecture showed a decrease in operational costs.</p> <p>The CPSAM analysis showed issues in communication, articulation of processes and lacking knowledge of the whole value network. Some of the risks could be minimized by choosing scenario 2 as vendor management would be centralized and less complex. However, many of the recommended actions concern both scenarios, such as formalizing a collaboration blueprint, re-assessing contracts for suitability, defining and communicating roles and responsibilities and defining and articulating communication practices.</p>		
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Professur: Nätverksekonomi		
Övervakare: Prof. Heikki Hämmäinen		
Handledare: Ekon. Mag. Marianne Owren		
<p>Syftet med detta diplomarbete är att undersöka ett litet företags icke-centrerade IT arkitektur i jämförelse med en centrerad molnbaserad IT arkitektur. Molntjänster är attraktiva för små företag eftersom startavgiften för investeringen är låg och kostnadsmodellen ändras till så kallad ”pay-as-you-go” modell där man endast betalar för de tjänster som används. Andra egenskaper som mindre företag uppskattar är flexibilitet, modularitet och användarvänlighet. Dock är det viktigt att ta i beaktande så kallade gömda kostnader som till exempel kan bestå av extra utgifter eller premium support kostnader.</p> <p>Studien undersöker de två scenarierna (dispergerad och konvergerad) både ur ett Total ägandekostnads perspektiv (TCO) och ur ett maturitets perspektiv (CPSAM) där kundens och leverantörens strategiska positionering analyseras. Analysen på Total ägandekostnader ger kostnadsinformation för båda scenarierna och utgående från den information kan man identifiera besparingsmöjligheter och eventuella överskott i utgifter. CPSAM analysen studerar outsourcing strategier och avslöjar problem i leverantörshanteringen.</p> <p>Utgående från Total ägandekostnads analysen härstammar de största kostnadsskillnaderna från operativa kostnader så som underhåll och support. Dessa kostnader kan variera men även då en felmarginal tas i beaktande är skillnaden i kostnader tydlig. Den konvergerade IT arkitekturen leder till lägre operativa kostnader.</p> <p>Baserat på maturitets analysen kunde det konstateras att problemen relaterar till kommunikation, processartikulation, och bristande helhetskunskap. En del risker kunde minimeras med en konvergerad IT arkitektur, scenario 2, eftersom leverantörshanteringen skulle centraliseras och därmed bli mindre komplex. Däremot är de flesta rekommendationerna aktuella för båda scenarier, såsom formalisering och standardisering av samarbetspraxis, omvärdering av kontrakt för att möta dagens krav, definiering och kommunikation av roller och ansvarsområden, och definiering och artikulation av kommunikations praxis.</p>		
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Preface

This thesis was carried out in collaboration with a small sized enterprise and the study was conducted on that certain company's IT architecture and IT outsourcing collaborations. I want to thank the company for enabling me to write this thesis, hopefully providing them with useful information and recommendations on how to proceed with their IT strategy.

I also want to thank my advisor, Marianne Owren, for tutoring me and providing me with information needed to make this thesis a reality. Also, I want to thank Marianne for connecting me with the IT experts at the provider companies and allowing me to interview them for my thesis. I also want to thank the IT experts for meeting with me and openly discussing with me the IT solutions and collaboration strategies.

I want to thank my supervisor, Professor Heikki Hämmäinen, for all his advices and support. The guidance I got helped me to focus on the essential and to gather my thoughts when the thesis writing process at times felt chaotic.

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Terms and Abbreviations

aPaaS	Application Platform-as-a-Service
CAPEX	Capital Expenditures
CMM	Capability Maturity Model
CPSAM	Customer-Provider Strategic Alignment Maturity
CSP	Cloud Service Provider
ERP	Enterprise Resource Planning
GDPR	General Data Protection Regulation
HR	Human Resources
HVAC	Heating, Ventilation and Air-Conditioning
IaaS	Infrastructure-as-a-service
IT	Information Technology
NIST	National Institute of Standards and Technology
OPEX	Operational Expenditures
PaaS	Platform-as-a-Service
SaaS	Software-as-a-Service
SAM	Strategic Alignment Model
SEI	Software Engineering Institute
SME	Small to Medium sized Enterprise
TCO	Total Cost of Ownership

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1 Introduction

1.1 Motivation

In recent years, several information technology (IT) buzzwords have been flying around attracting businesses to re-invent their digital strategy. These include “Cloud Computing”, “Big Data” and “Internet of Things”. Companies are interested in what these technologies possibly can do for their businesses and how they could further their business strategy. They must consider if it is profitable to jump on the trends or if the more traditional approach is better in the long run.

Cloud computing is applicable for all sizes of companies and all industries and therefore relevant to consider. What many find appealing with cloud computing is the flexibility, scalability and the pay-as-you-go aspects [1], [2]. However, a study on what small to medium sized enterprises (SME’s) value most when it comes to cloud computing is, in order of most valued to least valued, “ease of use and convenience”, “security and privacy”, “cost reduction”, “reliability”, and “collaboration and sharing” [3].

The digital jungle can be difficult for companies to navigate, especially for SME’s with little IT resources. Key elements for any executive considering implementing new IT infrastructure are the total costs both short-term and long-term. A common method of measuring IT investment costs, particularly cloud investment costs, is Total Cost of Ownership (TCO). The aim of this method is to take into consideration all costs involved with implementing a new product and/or service. However, the costs do not exclusively consist of implementation costs rather the life-time costs of the product and/or service.

Another key issue IT executives face is the alignment of Business and IT. A successful introduction of a cloud-based IT solution to the business structure is dependent on the alignment of Business and IT. Most Business-IT alignment studies focus on the internal alignment, however a few studies, such as the Customer-Provider Strategic Alignment Maturity model, consider the alignment of Business with outsourced IT services [4]. The CPSAM model studies many aspects of the customer-provider alignment and vendor management is a major part of the process. Implementing IT trends into the business structure entails introducing new vendors, products or services and further emphasizes the importance of vendor management.

1.2 Problem Statement and Scope

The purpose of this study is to identify what the benefits of a converged cloud based solution for a small sized enterprise are. This includes analyzing whether continuing with the current dispersed IT architecture versus moving to a converged cloud based IT infrastructure is more cost effective in the long-term. The second aspect to study is whether the converged solution also can ease the issues posed by the outsourcing structure and meet the current needs. The research question and the sub questions therefore are;

What are the benefits of a converged versus a dispersed cloud solution for a small sized enterprise?

- i. Which solution is most cost efficient?
- ii. Can the proposed solution meet the current needs and solve the issues of the outsourcing strategy?

The current, dispersed IT architecture includes several IT providers contributing with different key resources meaning that the outsourcing success greatly depends on the collaboration of the providers. In the converged cloud scenario, most key resources are offered by one provider and its partners leading to a less complex collaboration structure. To understand the cost differences between the two scenarios long term, the TCO model will be used. Furthermore, the maturity model will be used as means of assessing the current IT vendor management and together with the result of the TCO construct the recommended action for the case company. The maturity model will also aid in understanding the underlying problems of the current system and to understand whether a new solution could solve these issues.

1.3 Methods

The methods used in this thesis include a literature study and a case study. The theory that the thesis is based upon and that builds the framework for the analysis is presented in the literature study. The purpose of the literature study is to introduce the basis of cloud computing, the total cost of ownership method and the maturity model. The previous studies on TCO and maturity models provide a good basis for the frameworks used in the case study. The case study consists of two scenarios and an analysis both in terms of TCO and strategic alignment maturity. The research design includes semi-structured qualitative

interviews with the IT providers and the case company and examination of documents provided by the case company.

1.4 Outline

This thesis includes a literature review presented in the three following chapters and a case study. In chapter two the focus lies on the basics of cloud computing while chapter 3 and 4 present the theoretic framework used as a basis for the case study. The theoretic framework builds on literature on the topics of Total Cost of Ownership (TCO) presented in chapter 3 and Maturity Models presented in chapter 4.

Chapter 5 presents the methods and the case study in more detail, including the process and findings of the Total Cost of Ownership and Customer-Provider Strategic Alignment Maturity analyses. Last, in chapter 6, the main results are presented, assessed and discussed in terms of what the implications are for the case company.

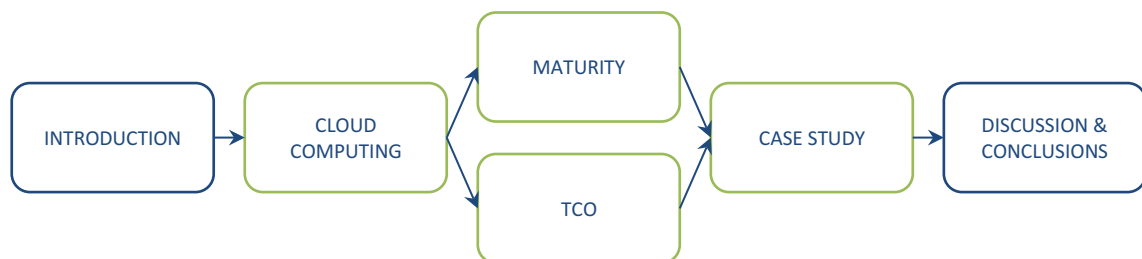


Figure 1: Thesis Outline

2 Cloud Computing

The purpose of this chapter is to introduce cloud computing. First cloud computing is defined including the key technologies involved. Second different service- and deployment models are described followed by the positive and negative aspects of implementing a cloud solution. Last the EU data protection reform is introduced with focus on the articles directly affecting cloud service providers (CSPs).

2.1 Definition

According to Gartner cloud computing is defined as "A style of computing where scalable and elastic IT-related capabilities are provided 'as a service' to external customers using Internet technologies." [5]. There are two underlying technologies, virtualization and grid computing [6]. Virtualization simplifies the interaction between systems, applications and end users by masking the physical characteristics of computing resources [6]. Grid computing, on the other hand, is a technology for solving a problem using software to merge the computational power of numerous computers, therefore connecting them in a grid [6]. Virtualization and grid computing allow for flexibility and availability which are two of the cornerstones of cloud computing.

Cloud computing advocates availability and on-demand network access to a common pool of computing resources. The model consists of five characteristics; on-demand self-service, broad network access, resource pooling/multi-tenancy, rapid elasticity, and measured service. Key technologies that enable cloud computing include fast wide-area networks, servers, and virtualization hardware. [7]

There are slightly different definitions for cloud computing depending on the service offered. For IT software users, computing, storage, and applications are delivered over the Internet, for Internet application developers, software development platforms are offered over the Internet and as for the third model a full infrastructure is offered via the Internet [8]. All these three variations will be presented in more detail in the following section.

2.2 Cloud service models

According to several sources, including Sultan, the National Institute of Standards and Technology (NIST) and Gartner, cloud-computing services can be categorized into three

models, Software-as-a-service (SaaS), Platform-as-a-service (PaaS), and Infrastructure-as-a-service (IaaS) as illustrated in Figure 2. According to Mather SaaS is maturing, PaaS is promising, and IaaS is evolving. [7], [9]–[13]

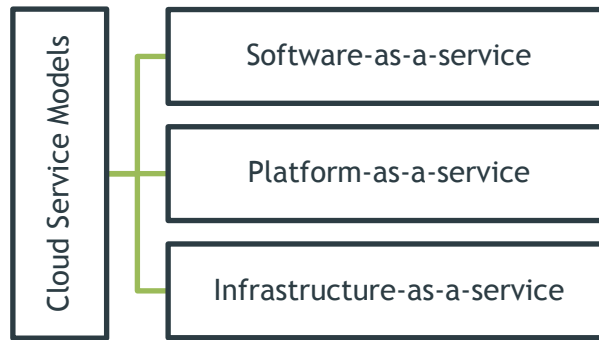


Figure 2: Cloud service models

SaaS is the most well-known model of the three, and furthermore the most mature [3]. The software is delivered by the provider/vendor via the Internet as a service. The difference from traditional software use is that the end-user can implement the software directly without downloading it to the computer. The Internet native applications have cloud specific design, development and deployment, they host data for multiple tenants, and they have built-in measuring and management systems. The client tools are browser-based and customization is done through configuration. SaaS is dependent on network capabilities and on the cloud service provider, the client bandwidth is also limited which affects performance. Limited versions of the SaaS applications can sometimes be licensed for free and then offered as subscriptions if full version is needed [13]. Typical types of products used through SaaS are word processing, Customer Relationship Management (CRM), and Enterprise Resource Planning (ERP) software. Examples of SaaS products are Yahoo mail, Gmail, Facebook, Salesforce.com and Google Apps. [6], [14]

PaaS replaces the traditional computing model for local management of operating systems (OS), databases, middleware, web servers, and related software [12]. The end-user gets access to software development kits, tools, and platforms rendering buying software licenses unnecessary [3]. This enables users to develop applications that run on the cloud [13]. The platform often also offers multiple applications for quick deployment [13]. According to Gartner the main PaaS hype is focused around application PaaS (aPaaS) [11].

As with the SaaS solutions, PaaS solutions serve multiple tenants hosting their data. PaaS supports scalability and integrated management of performance, resource consumption and load [14]. Examples of PaaS products are Google App Engine, Microsoft Azure, Amazon Web Services (AWS), and Force.com. [6]

The third service model, *IaaS*, is highly standardized, scaled and automated. The CSPs owns storage and networking capabilities and offers these to the client to meet demand. The service consists of full computer infrastructure (servers, virtual computers, storage, etc.) and the client gains access to the offering from any device via the Internet using authentication information. The consumer controls OS, memory, storage, servers and deployment configurations [14]. Some of the most known IaaS services are Amazon EC2, EBS and S3, JoyentCloud, and Microsoft Azure. [3], [6], [9], [13]

2.3 Cloud deployment models

According to NIST there are four different cloud deployment models; private cloud, community cloud, public cloud, and hybrid cloud [7]. The two main models, private and public, are sometimes also referred to as internal and external clouds respectively and are illustrated in Figure 3 [13]. These differ in governance and relation of the cloud to the enterprise [13].

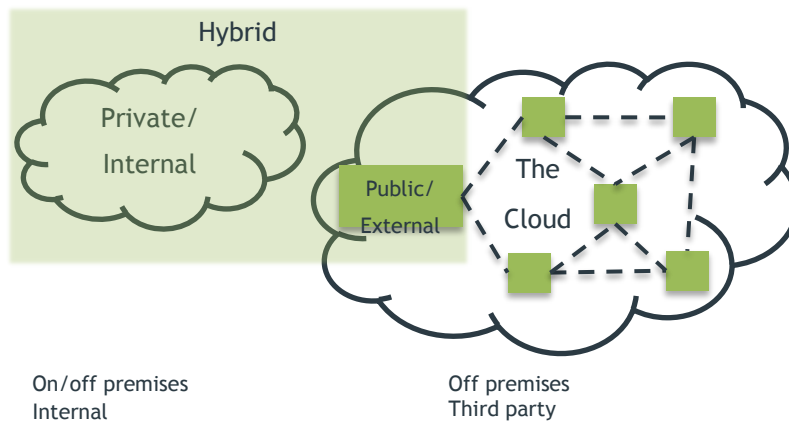


Figure 3: Cloud deployment models

The private cloud deployment model refers to a cloud exclusively used by a single organization or in a way that the organization's cloud services are isolated from other organizations' cloud services. The organization, a third party, or a combination of the two can own, manage and run the cloud. Also, it can exist either on or off premises. Private

cloud customers have higher degree of control over the cloud than do public cloud customers. It is also easier to ensure a level of security and protection standards meeting the corporate standards when implementing a private cloud. [7], [13], [15]

A variation of the private cloud is the community cloud. A limited community of organizations or employees with similar concerns, such as mission, security, privacy, policy, and performance requirements, get exclusive access to the cloud. Management, ownership, and operations can be run by community-organizations, a third party or a combination of them. The community-members may want to include a security mechanism that enables them to review the users trying to enter the community cloud. The cloud may exist on or off premises. [7], [13], [16]

The public cloud is offered to multiple clients over the Internet. The client has low level of control of the cloud infrastructure. According to Gartner this kind of cloud generates cost reduction through economies of scale and resource sharing [17]. Any type of organization can own, manage, or operate a cloud of this type. The cloud exists on the premises of the CSP. Public clouds are often implemented for personal use as they are affordable options, however SME's do at times also implement these solutions due to their affordability. Public clouds of this sort include Google Drive, Dropbox, iCloud and One Drive. [3], [7], [13]

The hybrid cloud is a combination of internal and external cloud services. It combines two or more deployment models, which are connected whilst remaining as unique entities. This can mean keeping core applications and data in-house in a private cloud while non-core application is run on a public cloud. This is a common solution for companies, complementing a private cloud with a public cloud for extra capacity [18]. The cloud is policy-based and uses standardized technology enabling flexibility of data and application and ensuring resource balancing. [7], [13], [19]

2.4 Cloud computing opportunities and threats

There are many advantages associated with adopting cloud computing, however the most commonly talked about advantage is moving from capital expenditures (CAPEX) to operational expenditures (OPEX). Traditionally IT expenditures require front-loaded software and hardware investment in addition to life-cycle investment in maintenance and service. When moving to the cloud a majority of expenses shift to a pay-as-you-go model from a high upfront investment model. According to Mather the IT environment also moves from high complexity to modular architecture. The modular architecture can grow

and change rapidly reacting to market and demand changes. Also, the reliability costs for a traditional infrastructure can be quite high, whereas in the cloud model the reliability is built into the architecture. [8], [13], [18]

According to Lin et al. cloud computing can help an enterprise shift resources to “long-term strategic business development” [8]. Cloud computing helps businesses with sustainability as there should be fewer points of failure and better resilience due to clustering. Also as the CSPs can gain economies of scale they have the means to invest in advanced resilience solutions. When it comes to SME’s the investments in IT can sometimes be difficult to justify and responding to market changes and technology advances in a timely manner can be challenging. The low up-front investment, flexibility, sustainability and modularity of cloud computing are therefore attractive traits from the viewpoint of SMEs. [13], [20]

In addition to the positive financial aspects of adopting cloud computing there are naturally also negative aspects. Gartner mentions the importance of evaluating both the positive and negative aspects before deciding whether or not the cloud solution makes financial sense[5]. They list the positive and negative aspects as presented in Table 1 [5].

Table 1: Financial aspects of adopting cloud computing

Positive financial aspects	Negative financial aspects
<ul style="list-style-type: none"> ▪ Greater cost agility with IaaS ▪ Increased retained cash ▪ Reduced opportunity costs ▪ Lower entry/exit cost ▪ Lower total cost of ownership ▪ Greater economies of scale from cloud service providers 	<ul style="list-style-type: none"> ▪ Less cost agility with SaaS ▪ Higher subscription fees ▪ High switching costs with SaaS ▪ Hidden extra costs

Because of the variable nature of cloud computing costs, they can quickly decrease when there is a reduction in demand for a service making this environment more cost agile. The mistake often made by IT leaders is over purchasing or unit price inefficiency when an item/service is utilized for a long period of time. With the cloud pay-as-you-go model this can be avoided. When implementing a cloud solution, the savings of not purchasing hardware can be redistributed to either shareholders or to reduce debt therefore reducing opportunity cost. Furthermore, the up-front investment is lower and therefore cash to invest in another opportunity is made available. This also reduces opportunity cost. [5]

Another positive aspect of cloud services is the low entry/exit costs, which gives IT executives the means to quickly react to market changes. Typically, the pay-as-you-go nature of cloud services decreases the total cost of ownership. For SME's leveraging unit discounts provided by CSPs are key when competing on cost. [5]

When it comes to SaaS, clients might end up in a situation where they pay for more licenses than they use, therefore leading to less cost agility than with IaaS. The switching costs related to SaaS can also be high when moving data out and bringing it back on premises. Like with any service there are often some hidden costs involved. These can for example include extra fees for exceeding usage or premium support. [5]

Other negative aspects or concerns associated with cloud computing include control, vendor lock-in, performance issues, interoperability, security, reliability, and privacy [6]. In the more traditional IT structures the organization has control over all five layers of technology as shown in Figure 4 [13]. With the cloud service models an increasing amount of control move to the provider and in the case of SaaS, the provider gains control over all layers [13].

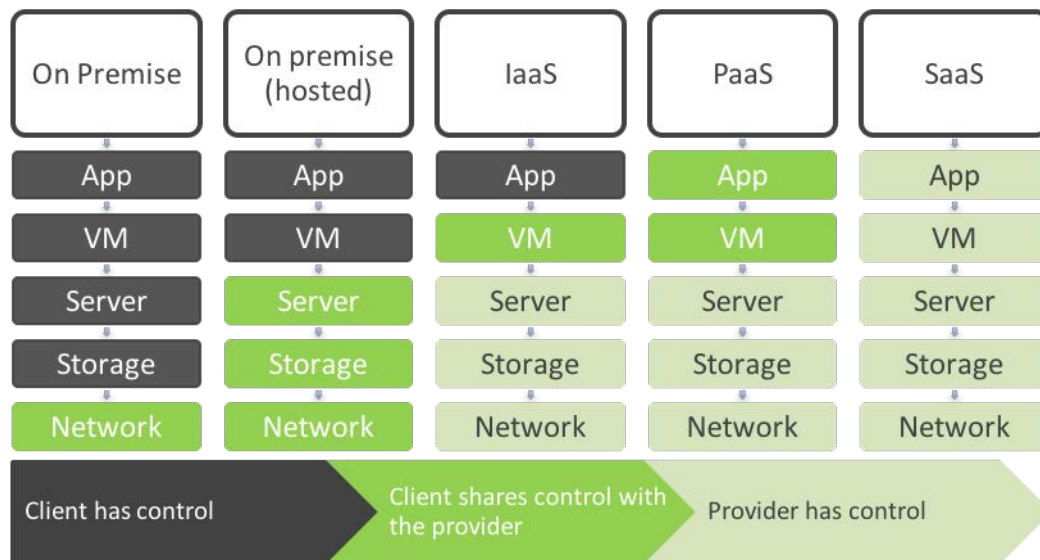


Figure 4: Governance and control of IT structures

In relation to privacy concerns, some enterprises or organizations have legal requirements that force them to maintain data within certain geographical regions [6]. Consequently, in order for these enterprises or organizations to adopt cloud computing the CSP should present options for preferred data center locations. Due to the EU data protection reform this is an even more universal dilemma that all companies and CSPs must take into

consideration. The data protection reform will be presented in more detail in the following subchapter.

2.5 Data protection reform

With the advances of technology follows data protection challenges. In 2012, the European Commission expressed the need for a reform in the data protection rules within EU. The official documents for the Regulation and the Directive were made public in May of 2016. Both the Regulation and the Directive entered in force in May of 2016 but will apply from May 2018 and be implemented as national law by EU Member States in May 2018. The goal of the reform is to give EU citizens more control over their personal data and to strengthen and merge the economies of the EU market. The reformed data protection rules, also called General Data Protection Regulation (GDPR), seek to ensure safe transfers of personal data within EU and also attempts to ensure protection of personal data that is exported abroad through specified rules concerning data transfers outside the EU. [21], [22]

“Directive 95/46/EC of the European Parliament and of the Council seeks to harmonise the protection of fundamental rights and freedoms of natural persons in respect of processing activities and to ensure the free flow of personal data between Member States.” [21]

The data protection reform inherently has an impact on cloud computing in many ways. As mentioned the reform aims to bring back control of personal data to the citizens (data subjects). There are four main categories of the reform that greatly affect cloud computing. These are: transparency and communication, rectification and erasure, security of personal data, and transfers of personal data to third countries and organizations. The transparency and communication considers informing the data subject of personal data processing procedures and right of access. Whereas the rectification and erasure articles ensure that the data subject can request for rectification of inaccurate personal data or erasure of personal data concerning him or her. In addition the data subject also has the right to restrict the processing of personal data and in case of erasure the data subject has the right to data portability. [21], [23]

The third category of data protection affecting cloud computing is security of personal data which incorporates security of processing and undue notification of data breach to both supervisory advisor and data subject. Perhaps the most relevant concern for cloud

computing is the international transfer of personal data. Many large CSPs have data centers all over the world and cannot always assure their client of keeping their data locally. According to the GDPR, the personal data should only be transferred to countries and organizations with the same level of security and data protection required for EU countries. According to Coles and Venkatraman many CSPs in 2014 did not meet the requirements set by the European Commission. These CSPs did not present the right information in their terms and conditions and did not have the needed data protection and as a result it could lead to serious penalties once the regulation applies. [21], [23], [24]

3 Total Cost of Ownership

As mentioned in the previous chapter moving from a more traditional storage strategy to cloud computing often causes a shift from capital expenditures to operational expenditures. To assess the lifetime costs of this type of investment many aspect must be considered. This is the aim of the Total Cost of Ownership method that will be presented in the following chapter. First the model is described including its history and background followed by a presentation of the benefits and barriers. Last implementations are discussed including different implementation approaches.

3.1 Definition

The Total Cost of Ownership (TCO) model was made popular in 1986 when Gartner published an analysis of the “life cycle cost of PCs”. This study then evolved into modern day TCO research. [25], [26]

According to Gartner the TCO model is recognized as the industry-standard for financial analysis of IT costs [26]. The TCO model defined by Gartner bases on a “chart of accounts” listing all costs that should be taken into consideration [26]. The phrase “Total Cost of Ownership” refers to taking into account “all costs associated with the acquisition, use and maintenance of an item” [27]. TCO is a progressive and systematic efficiency measure that facilitates analyzing, managing and understanding of the total costs of purchasing an item or service [27].

TCO helps service-oriented departments such as IT gain better price and performance ratios in their key business processes [25]. These processes can for example be operations, disaster recovery, management and tech support. In IT the method is used for comparing costs to a baseline, evaluating what-if scenarios and understanding future costs [26]. The main reasons for adopting TCO is according to Ellram, provider selection decisions, measuring ongoing provider performance, and driving major process changes [28] .

TCO can be implemented for any type of purchase and it should not only be used for make-or-buy decisions, it is also relevant after the purchase to evaluate the provider’s performance [28]. TCO helps executives make more well-informed decisions.

3.2 Cost components

The determination of cost elements and gathering of cost data can often lead to incomplete results as the focus tends to be on the price rather than on the actual total cost of ownership and purchasing decision consequences [27]. There are different ways in which the costs can be viewed, helping with identifying all costs involved. Gartner focuses on direct versus indirect costs while Ellram divides the purchasing costs into pre-transaction, transaction, and post-transaction cost elements. The direct versus indirect cost division is based on how these costs relate to some activity. The transaction cost elements on the other hand are linked to where in the purchasing cycle they occur. [26], [29]

The direct costs can be traced to an activity that is linked to an accounting line item, purchase order, budget line item, payroll or an accounts payable. A direct cost item can be for example related to software, maintenance, hardware, communication or IT operations. These costs are quite straightforward to determine and gather, as they are quantifiable unlike most of the indirect costs. [26]

The indirect cost elements can for example be labor costs due to downtime associated with end-users' use of activities or assets. Indirect costs support activities but are not directly linked to some certain activity. Also "peer-support", when one employee acts as IT support for another employee, is an example of an indirect cost. Costs may also associate to other department budgets; however, these should still be accounted for if a proper TCO is the goal. The indirect costs can be difficult to quantify, as they are not directly traceable to an accounting line item. [26], [27]

As stated earlier the cost elements can also be divided into pre-transaction, transaction, and post-transaction costs. The major cost components related to each category are presented in Figure 5 [29].

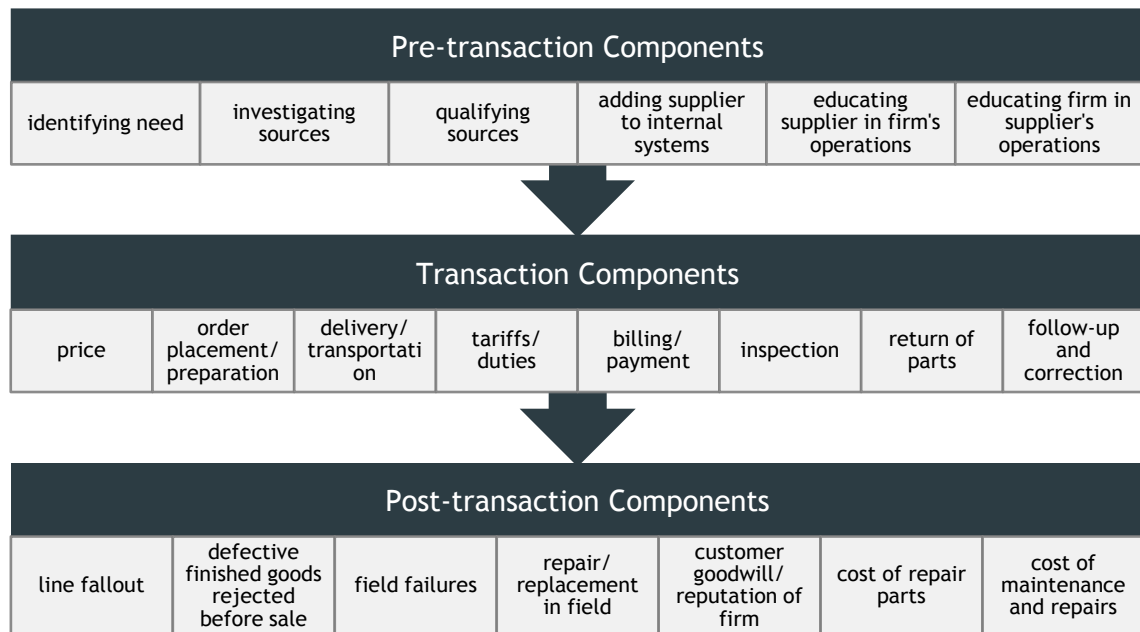


Figure 5: Cost Components

The cost elements that are categorized as pre-transaction costs occur before the actual purchase, i.e. prior to placing the order. Included in pre-transaction costs are for example, cost of investigating offers, cost of adapting systems, and cost of educating providers on the firm's expectations and systems. All costs that predate the purchase order but are part of the purchase activity are included as pre-transaction costs. [29]

Included in the transaction costs are elements such as order placement, the price of the item or service itself, auditing and matching of order, and correction of incorrect documents. These cost elements tend to get more attention than the pre-transaction and post-transaction costs. This is due to the fact that these costs are closest related to the transaction itself. [29]

The costs that occur once the purchased item or service is owned by the firm, or any affiliate of the firm, are categorized as post-transaction costs. These costs may occur directly after the order is received or even a few years later when the item/service is in use, being repaired, adjusted or discarded. The post-transaction costs are difficult to estimate and therefore sometimes overlooked. [29]

3.3 Benefits and barriers of using the TCO model

As mentioned earlier the TCO model forces the organization to take a detailed look at the activities that produce costs. A benefit of this process is the identification of activities that

produce costs but that do not add value. The purpose of this part is to present the benefits and barriers of using the TCO model.

The benefits of implementing TCO can be categorized into five main categories adding value to each of these. The categories are performance measurement, communication, insight/understanding, supporting continuous improvement, and decision-making. The most common reason for adopting TCO is provider selection and naturally there are many benefits of using TCO for decision-making. First, the total cost of the item/service is brought into perspective making the provider selection decision more informed. Second, the method creates an analytical environment for problem solving by quantifying tradeoffs. [27], [29]

When it comes to insight and understanding, TCO provides means of negotiating, analyzing and driving changes in IT operations. The information gathered with TCO is an essential part of all three activities. TCO also broadens the purchasing personnel's perspective and helps them take a "big picture" approach, moving from a price only perspective to a total cost focus. The information gathered also helps the firm identify the domains that need improvement efforts, opportunities to reduce costs and find where the internal issues lie, leading to continuous improvement. It does not only measure internal performance, but can help evaluate provider performance. [29]

Compared to most other cost of ownership models, TCO takes into consideration a broader spectrum of purchase costs as it looks at the life cycle costs of the item or service being assessed [29]. As a result of the broader spectrum, TCO brings awareness to the non-price activities, or "hidden costs", contributing to the total costs [20], [29]. Other functions of the firm are also activated in the purchasing decisions when using TCO. It leads to improved internal communication and external communication to providers.

According to Mayor the TCO method can, when combined with recognized benchmarks, make a good framework for determining and managing IT spending [25]. Nevertheless, TCO does not take into consideration risk or contributes with a way to coordinate technology with strategic business goals [25]. Because of the complexity of TCO it can easily become time-consuming and difficult to implement [30]. The main issues with TCO implementations is lack of data resources, training and education on the use of TCO and data gathering. Most company reporting systems do not provide enough information for the TCO which in turn means that some of the data gathering must be done manually.

Another difficult aspect of TCO cost gathering is that elements such as indirect costs are not directly quantifiable. [26], [29], [31]

3.4 Implementation of the TCO model

In the following part the process of implementing TCO will be addressed. As mentioned previously, Gartner and Ellram's methods differ slightly, although the underlying process is the same. This process is illustrated in Figure 6. [29], [32], [33]

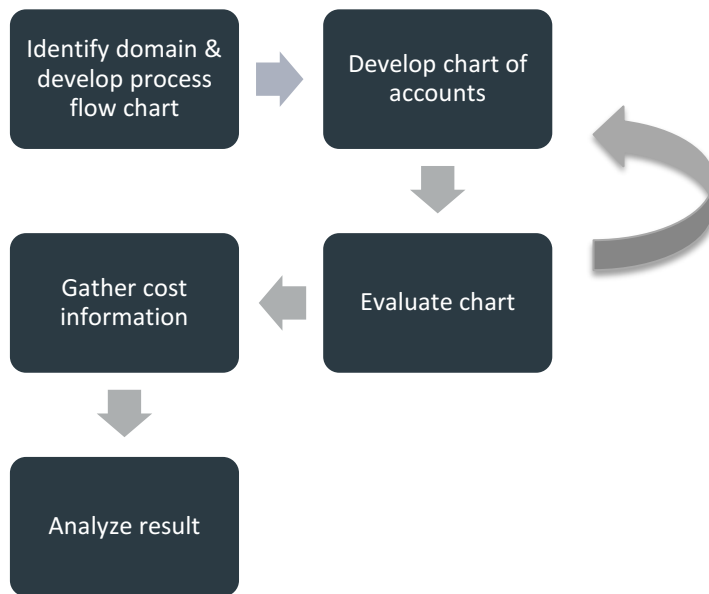


Figure 6: TCO process

The first step according to both sources is to clearly identify the domain that is being assessed and then develop a diagram or chart of accounts. According to Gartner there are five key cost components: cost to implement, cost to operate, cost to support and maintain, cost to enhance and extend, and cost to decommission, whereas Ellram uses a framework that groups purchasing activities into six categories, management, delivery, service, communications, price, and quality. For clarity, both approaches TCO components are presented in Table 2. [29], [32], [33]

Table 2: TCO grouping strategies

Gartner	Ellram
Cost to Implement	Management
Cost to Operate	Delivery
Cost to Support & Maintain	Service

Cost to Enhance & Extend	Communication
Cost to Decommission	Price
	Quality

The grouping strategies facilitate the process of identifying all cost elements significant for the domain being analyzed and is essential for making the TCO process manageable. The activities should also be evaluated to see which activities are most time-consuming, what the cost-levels of each activity is, what determines the cost levels and which activities' cost information is easily accessible. [29], [32], [33]

To satisfy the total cost philosophy these cost activities should cover pre-transaction, transaction, and post-transaction costs, alternatively direct and indirect costs. The information gathered from this process will help evaluating which costs to include in the TCO analysis. [26], [27], [29]

Once the costs are identified they should be examined to determine which components are significant, and which components make up the majority of TCO expenses. This is according to Ellram done using Pareto's Principle and common sense. When the key cost components are identified they should be gathered and the result analyzed. [26], [29]

Ellram also introduces three different models for determining TCO. These are Dollar-based-direct cost, Dollar-based-formula, and Value-based approach and they are presented in Table 3 [28]. The Dollar-based approach focuses on gathering actual cost data for all the relevant TCO elements, determining which cost elements to include and collecting the related data. This process can be quite complicated; however, analyzing the result is straightforward. The other variation of dollar-based uses formulae to appropriate actual costs by item bought. The formula is based on the resource level required for a specific activity, similar to activity-based costing. This approach results in higher accuracy of the true cost of doing business and is good for repetitive decisions. [28]

The Value-based approach combines cost data with performance data transforming qualitative data to quantitative data. As qualitative data can be quite difficult to "dollarize" this approach can become a challenge. The cost derived from value-based models is not directly linkable to dollars spent pre-transaction, during transaction, or post-transaction, unlike when using the dollar-based approaches. The value-based model derived costs need to be fine-tuned and proper weightings need to be developed to reflect TCO. As this

approach can become complex, it usually focuses on a few major issues, generally three or four. [28]

It can be a challenge deciding whether to focus on ease of use versus complex and flexible enough to cover key issues when developing a TCO approach. Therefore, the advantages and disadvantages of the models need to be weighed against each other to find the model best suited for each scenario. Some of the primary uses of the models are also listed in Table 3. [28]

Table 3: TCO determination approaches

	Model advantages	Disadvantages	Primary uses
Dollar-based direct cost	<ul style="list-style-type: none"> ➤ Tailor factors considered to decision ➤ Very flexible ➤ Alter level of complexity to fit decision ➤ Help identify critical issues 	<ul style="list-style-type: none"> ➤ Time consuming ➤ Does not make sense for repetitive decisions ➤ Not cost beneficial for low dollar buys 	<ul style="list-style-type: none"> ➤ Provider selection ➤ Supply base reduction ➤ Make versus buy/outsource ➤ Process improvement
Dollar-based – formula	<ul style="list-style-type: none"> ➤ Easy to use once system is in place ➤ Excellent for repetitive decisions where costs for key factors can be determined 	<ul style="list-style-type: none"> ➤ Time consuming to establish system ➤ Formulae need to be periodically reviewed and updated ➤ Inflexible to different types of decisions ➤ Considers a limited set of factors 	<ul style="list-style-type: none"> ➤ Provider volume allocation ➤ Supply base reduction ➤ Ongoing provider evaluation ➤ Process improvement
Value-based model	<ul style="list-style-type: none"> ➤ Can incorporate issues where costs cannot be determined ➤ Considers the importance of factors using weighting ➤ Easy to use for repetitive decisions 	<ul style="list-style-type: none"> ➤ Time consuming to develop; only good for important and/or repetitive decisions ➤ Much judgment in establishing weightings 	<ul style="list-style-type: none"> ➤ Provider selection ➤ Make versus buy/outsource ➤ Process improvement

4 Maturity Model

With the introduction of new IT solutions such as e-commerce and cloud computing comes an increase in vendors, products and/or services that the organization must manage. When it comes to outsourcing IT the sourcing management does not only concern the alignment of IT and business but also to alignment of customer and provider. This chapter presents previous studies on Business-IT alignment and maturity models that can provide organizations with critical insights in process development and improvement.

4.1 Capability Maturity Model

The process-maturity framework development started in November 1986 at the Software Engineering Institute (SEI) with assistance from MITRE Corporation. SEI released a brief description of the process maturity framework in September 1987 and four years later, as a result of experience and the maturity questionnaire, the framework evolved into the Capability Maturity Model (CMM). [34]–[36]

The framework aims to help developers based on current process maturity, select process-development strategies and identify the most critical issues in need of improvement in software quality and process. The framework presents practices in some key process areas that have previously shown to improve software development and maintenance capacity. These key process areas are building blocks that identify the main problem areas that need to be addressed to achieve higher maturity. Maturity is defined as five different levels in the CMM with the first level depicting immaturity and the fifth depicting highest level of maturity. Immaturity often involves improvisation by practitioners and their managers and the organization is often described as reactionary. Project schedules and budgets are frequently exceeded as they are not based on previous experience and realistic estimates. These types of organizations typically have no objective quality control or problem-solving process. [34], [37]

As a contrast a mature organization has ability to manage development and maintenance over the whole organization. Maturity entails good communication and planned processes that are updated when necessary. The project roles and responsibilities are clearly defined and there are clear quality control measurements and problem-solving processes are implemented. The schedules and budgets are based on previous projects and are thoroughly planned. The five levels of the CMM are presented in Table 4 [34]. [34]

As an organization rises in maturity standards and process policies are set and infrastructures and corporate cultures are built to support the methods and practices of the organization. A consequence of increased maturity is that the difference between predicted results and realized results shrinks. Second, the variability of realized results around predicted results decreases when maturity increases. [34]

Table 4: CMM Maturity Levels

Level 1 - Initial

- No stable environment for developing and maintaining software
- Difficulties with crises and making commitments
- Success depends on having an exceptional manager and a seasoned and effective development team
- Capability is characteristic of individuals, not organizations

Level 2 - Repeatable

- Policies for managing a project and procedures to implement those policies are established
- Planning and management of new projects is based on experience
- Cost and schedules are tracked
- Capability can be summarized as disciplined because project planning and tracking are stable and earlier successes can be repeated

Level 3 - Defined

- Standards and typical processes are documented
- Organization-wide training
- Well-defined process and management has good insight into the progress of the projects
- Capability can be summarized as standard and consistent due to stability and repeatability of the activities
- Costs, schedule, functionality and quality is tracked and under control
- Organization-wide understanding of activities, roles and responsibilities

Level 4 - Managed

- Quantitative goals are set for both products and processes
- Productivity and quality is measured and a process database stores the data for analysis
- Capability can be summarized as quantifiable and predictable
- An organization of this maturity level has the means to predict trends in process and product quality
- In case of exceptional circumstances the organization can identify and manage the cause of the variation

Level 5 - Optimizing

- The organization is focused on continuous improvement
- The process can be strengthened proactively by identifying weaknesses and preventing defects
- Defect causes are analyzed in order to prevent reoccurrences
- Capability can be summarized as continuously improving
- Improvements happen in terms of process development a (technology) innovation
- Changes are made after performing cost-benefit analyses of the new technologies or process developments

As mentioned previously the key process areas help define the issues that need to be resolved to achieve a maturity level. Because the first maturity level is the lowest form of maturity it does not require any effort in key process areas to be achieved. The key process areas exist exclusively on each maturity level. The purpose of the key process areas is to achieve goals. These goals can be used to define whether a key process area is effectively implemented by the project/organization. They signify the purpose, the scope and the boundaries of each key process area. The lowest level of the CMM is the key practices, they define the policies, procedures and activities that have most effect on the institutionalization of the key process area. The details of the key practices are of importance as they are mainly used to aid groups such as software engineers. The key practices are organized by common features that identify the attributes that can be used to examine the efficiency, repeatability, and endurance of the implementation of a key process area. Common features for the key practices are Commitment to Perform, Ability to Perform, Activities Performed, Monitoring Implementation, and Verifying Implementation. [37]

First, the actions organizations must perform to establish the process and ensure endurance are part of the Commitment to Perform features. These actions often involve senior management sponsorship and established policies. Second, the Ability to Perform includes the requirements of implementing the process efficiently. This often involves training, appropriate skills and appropriate tools. Third, the largest category of key practices is part of the Activities Performed which specifies the steps needed to establish the key process area. This often involves planning, performing the work, and verifying and correcting of results. Fourth, the steps needed to measure the process, analyse measurements, and act based on results are part of the Monitoring Implementation. Fifth, Verifying Implementation includes the steps required for coordination and ensuring that activities are performed in line with the specified processes. These steps usually include reviews and audits. [37]

4.2 Customer-Provider Strategic Alignment Maturity

The Strategic Alignment Maturity (SAM) model addresses the alignment of IT with business and vice versa. The process of gaining IT-business alignment is a long-term journey requiring assessment of the IT-business working relationship and how IT and business is viewed by both parties. According to Luftman successful alignment depends mainly on building the right relationships and processes and incorporating essential training

[38]. The model builds on the CMM and includes six components of alignment and 38 practices. In this case the components are similar to the common features presented in the CMM model. The SAM components and practices are presented in Table 5. The complete list presented by Luftman includes the related maturity levels (see Appendix A) [38]. [38]–[40]

Table 5: SAM components and practices

Communications	Understanding of Business by IT	Partnership	Business Perception of IT
	Understanding of IT by Business		IT's role in strategic business planning
	Organizational Learning		Shared Risks and Rewards
	Style and Ease of Access		Managing the IT-Business Relationship
	Leveraging Intellectual Assets		Relationship/Trust Style
	IT-Business Liaison Staff		Business Sponsors/Champions
Competency/ Value Measurements	IT metrics	Technology Scope	Primary Systems
	Business Metrics		
	Link between IT and Business Metrics		Standards
	Service Level Agreements		
	Benchmarking		Architectural Integration
	Formally Assess IT Investments		
	Continuous Improvement Practices		How IT Infrastructure is Perceived
Governance	Formal Business Strategy Planning	Skills	Innovative, Entrepreneurial Environment
	Formal IT Strategy Planning		Key IT HR Decisions Made by:
	Organizational Structure		Change Readiness
	Reporting Relationships		Career Crossover Opportunities
	How IT is Budgeted		
	Rational for IT Spending		Cross-Functional Training and Job Rotation
	Senior-Level IT Steering Committee		Social Interaction
	How Projects are Prioritized		Attract and Retain Top Talent

The Customer-Provider Strategic Alignment Maturity (CPSAM) Model builds on research on efficiently managing outsourcing relationships and research on alignment models such as SAM [39], [41], [42]. CPSAM includes six components of alignment, 27 practices and

five maturity levels. The difference between SAM and CPSAM is that SAM focuses on the internal alignment of business and IT while CPSAM seeks to address the external alignment, the customer-provider relationship. As mentioned the CPSAM builds on the CMM, combining these project process development theories with customer-provider alignment measurements resulting in a maturity model on customer-provider collaboration. [4], [43]

The six components of CPSAM are presented in Table 6 and describe the different aspects to take into consideration when assessing customer-provider alignment [4]. These are Value Measurements, Governance, Partnership, Communications, Human Resources and Skills, and Scope and Architecture. The Value Measurement component assess the benefits gained by the customer and the provider both in technical and business terms. These are often part of the outsourcing agreement between the customer and the provider and capture the weight of the expectations for meeting certain metrics. The outsourcing projects tend to fail when there is dissonance in the expectations of customer and provider. [4]

The Governance component captures the structural aspects of the customer-provider relationship. In order for the outsourcing to succeed the structural governance of both customer and provider need to be aligned. This includes for example the establishment of planning strategies and meeting project schedules. The Partnership component defines the collaborative aspects of the outsourcing relationship. This includes informal meetings, trust-forming and the compatibility between customer and provider values, goals, and objectives. A related component is the Communication component that captures the extent to which information, ideas, and knowledge is effectively shared between the customer and the provider. An important part of communication is also the mutual understanding of the status of the project. [4]

Human Resources refers to the extent to which the customer and provider invest in hiring, training, motivation while Skills indicate the degree of complementary skills provided by both parties. More mature relationships engage not only in intra-firm development efforts but also cross-firm performance feedback and comprehensive skill/resource sharing. The Scope dimension specifies the extent of IT offerings outsourced and the roles and impact of customer and provider. While Architecture refers to the technology used for the collaboration, in other words the hardware, software and networking choices that build up

the infrastructure. In mature relationships providers typically work close with the customers in choosing and defining internal and external IT standards. [4]

Table 6: CPSAM components and practices

Value Measurements	Customer and Provider Metrics (tech. and bus.) for services	Communications	Customer Understanding of Provider
	SLA and Management Process		Provider Understanding of Customer
	Benchmarks		Organizational Learning and Knowledge Sharing
	Formal Assessments and Improvement Reviews		Customer-Provider Liaison
Governance	Use of Joint Strategic, Tactical and Operational Committees	Human Resources and Skills	Technical and Business Skills of Customer and Provider
	Formal/Informal Mechanisms		Cultural Match
	Prioritization Process		Change Readiness
	Resource Allocation Process		Cross Training/Education
	Statutory and Regulatory Requirements		Hiring/Retaining; Skills Management and Portfolio
Partnership	Role of Provider in Customer Strategy and Planning	Scope and Architecture	Architectural Agility, Transparency, Flexibility
	Shared Goals, Risks, Rewards/Penalties		Standards Adherence
	Mutual Trust		
	Formal and Informal Agreements		Impact of Provider Services on Customer and its Partners
	Joint Sponsor and Champions		

The maturity levels of the CPSAM model and the CMM maturity levels build on the same basic idea. However the CPSAM focuses more on the maturity of the outsourcing relationship and reflect how aligned the customer and the provider are. The first maturity level of CPSAM is characterized by low alignment between customer and provider and low harmony. The relationship between the customer and the provider tends to be rigid and formal, solely based on the contracts. Service Level Agreements (SLAs) and engagement planning are ad hoc and the customer-provider strategy is not integrated. The second level is characterized by strong commitment to align and emerging processes. However, some processes are still lacking in improvement. There is limited understanding of roles and

responsibilities and metrics and service levels are still more on the technical side rather than business oriented. The third level has focused and established strategic alignment between customer and provider and most processes display improved articulation and implementation while others are still evolving. The provider understands the customer and the customer's understanding of the provider is evolving. Some customer-provider planning is emerging and the SLA is starting to match enterprise-level goals. There is some willingness to engage in risk-sharing and more awareness of the value provided by the other party.

On the fourth level the customer and the provider has started to realize the value potential provided by each other. The relationship is characterized by higher degree of integration. There is more provider influence and the customer-provider strategy is integrated. The provider is viewed as a valuable asset and as a change enabler. The last and fifth level is characterized by a high level of integration of strategic planning and the customer and the provider co-adapts and co-develops when needed. This level is defined by flexibility and agility and organizations of this maturity level are able to change rapidly to meet requirements of the business environment. The organizations are tightly aligned and able to realize joint value. The measurement criteria for each maturity level are presented in Table 7 [4]. [4], [34]

Table 7: CPSAM measurement criteria

Level 1 Initial/Ad hoc process	<ul style="list-style-type: none"> • Value: No clear metrics/measurements • Governance: No formal structure/process • Partnership: Customer & Provider "at arms length" • Communication: Customer/Provider lack understanding of each other • HR & Skills: No education sharing; Basic technology focus • Scope & Architecture: Traditional operational/back office support
Level 2 Committed process	<ul style="list-style-type: none"> • Value: Effective technical metrics • Governance: Emerging formal operational processes • Partnership: Provider emerging as asset • Communication: Limited technical understanding and sharing • HR & Skills: Demonstrable technology expertise • Scope & Architecture: Departmental focus
Level 3 Established/Focused process	<ul style="list-style-type: none"> • Value: Effective technical metrics & emerging business metrics • Governance: Strategic mechanisms at business unit level • Partnership: Provider seen as valuable service asset • Communication: Good technical & business understanding emerging • HR & Skills: Balance of business & technical skills; shared technical training begun • Scope & Architecture: Integrated within a customer business unit

Level 4 Improved/Managed process	<ul style="list-style-type: none"> • Value: Metrics demonstrate clear strategic contribution • Governance: Joint strategic, tactical & operational committees • Partnership: Provider key participant in customer strategies • Communication: Strong technical & business understanding and knowledge sharing • HR & Skills: Strong business/industry expertise; shared business & technical education • Scope & Architecture: Integration across the customer's company
Level 5 Optimized process	<ul style="list-style-type: none"> • Value: Metrics extended to customer's partners • Governance: Oversight structure extended to customer partners • Partnership: Customer-Provider co-adaptive • Communication: Formal/Informal extended to clients customers • HR & Skills: Education & rewards shared • Scope & Architecture: Evolving with customer & customer partners

Gartner also presents a maturity model for vendor and sourcing management which shares similarities with the CPSAM model. This model also presents recommended actions for implementation and increase in maturity. The level descriptions and recommended actions are presented in Table 8 [44]. The model by Gartner focuses on application organizations and the goal of the model is to provide an improvement measure for vendor management. The study states that IT trends, such as mobile, cloud, agile and e-commerce, have led to an increase in number of IT vendors that the organization must manage. The Gartner model therefore aims to provide recommendations for improving vendor management strategies. An immature vendor management strategy may suffice on short term, however long term effectiveness will decrease and the organization suffer. [44]

Table 8: Gartner Vendor Management Maturity Levels

Level of Maturity	Characteristics	Recommended Actions
Level 1 Ad Hoc	<ul style="list-style-type: none"> • Processes are not specified and methods are defined by individuals • Little repeatability • Little/No knowledge sharing • No formal process for vendor and sourcing management • Ad hoc performance progress control • Reactive demand management 	<ul style="list-style-type: none"> • Clear vendor inventory • Clear division of roles, vendor management • Clear SLA metrics and definitions • Cost monitoring and performance measurements • Demand management for fluctuating projects/contracts • Identify problem areas (projects, vendors, contracts)
Level 2 Repeatable	<ul style="list-style-type: none"> • Little consistency across the organization in terms of process approach • Responsibility of vendor relationship and service and contract management is scattered • Basic cost and schedule measurements • Problem management and demand planning are 	<ul style="list-style-type: none"> • Vendor management includes all vendors and standard practices are defined • Communicate process practices across organization • Assess suitability of contract to current developments and processes

	<ul style="list-style-type: none"> ad hoc Problem resolution is the focus of relation to vendor 	<ul style="list-style-type: none"> Standardized contracts Define measurement standards and compare contracts to SLA parameters. Appoint role of performance manager Gather demand and capacity data for all contracts and analyze the data Define how external services are to be managed in relation to the contracts and SLAs
Level 3 Defined	<ul style="list-style-type: none"> The processes are defined and communicated across the organization Vendor management and sourcing are standardized Roles and responsibilities are also defined Performance is measured and compared to SLAs Demand patterns are analyzed to aid demand management 	<ul style="list-style-type: none"> Improve quality, innovation and business value by moving towards more strategic vendor management Assess suitability of contracts in an agile business environment and adapt services Include customer satisfaction and business parameters in performance management Make demand forecasts from expected trends Align internal and external IT services with business-level services according to requirements Include vendor management processes optimized for predictability and exploration (bimodal), deployment, development and innovation
Level 4 Agile	<ul style="list-style-type: none"> Vendors are picked not only based on performance but also based on future needs, attributes, and the working culture Contract management is more agile and includes renegotiation and demand management is based on projections Vendor management and sourcing are adjusted to fit the context of each process Performance management measure how well business goals are met. Including customer satisfaction. Service management includes the alignment of business and technology for both the customer and the vendors. 	<ul style="list-style-type: none"> Include the vendors in the development planning to identify new opportunities Partner with vendors in assessing suitability of the contracts in relation to performance and business agility Work closely with vendors in improving performance Automated and agile demand/capacity management Include the responsibility of business outcomes to service management Adapt the sourcing model based on assessments to fit the business direction
Level 5 Continuous	<ul style="list-style-type: none"> Simplified processes Shared responsibility with vendor Vendor actively part of suggesting improvement strategies Service management focuses on continuous improvement of business processes Continuous adjustments of contracts and services 	<ul style="list-style-type: none"> Actively monitor activities to avoid lapses Continuously support product and process innovation Investigate various delivery models for IT solutions and services

The maturity and alignment models presented share many similar traits aiming to help identify the maturity level or alignment of process/vendor management. The results of the frameworks provide information on which process areas to improve and develop, to rise in maturity.

5 Case Study

This chapter presents the purpose and goal of the case study in addition to the method used to evaluate the scenarios. First the research design and method is presented followed by the data collection strategy. In the second part the case company is described followed by a detailed presentation of the two scenarios. The first scenario represents the current situation with multi-sourced IT while the second scenario describes a more centralized sourcing strategy. Last the development of the TCO and the CPSAM studies are presented and discussed.

5.1 Research Design

Bryman et al. defines a case study as a “detailed and intensive analysis of a single case”. The case studied can for example be an organization, a location, a person or an event. Case studies are often associated with qualitative methods; however, the combination of quantitative and qualitative research is relevantly common. The case study is not restricted to one single case and can study several cases. Multiple-case studies are often implemented for comparative purpose which entails using relatively identical methods for analyzing two or more scenarios. [45]

Semi-structured qualitative interviews allow flexibility as the questions are used more as a guide and the interviewees have some freedom in how to answer. All interviewees are largely asked the questions in the same wording; however, the discussion may take different direction based on the answers they provide. Open questions allow the interviewees to answer in their own words and can direct the discussion to new territory. Open questions also allow the researcher to tap into the interviewees’ knowledge and understanding of the issues. [45]

The research process in this study is built up of three main parts, background, Total Cost of Ownership and Customer-Provider Strategic Alignment Maturity. The research methods included interviews, examination of material provided by the case company and researching previous studies. Table 9 summarizes the interviews held during the research process and the main topics of these interviews. During the background information gathering stage informal meetings were held with the customer however these are not listed as the information gained during the meetings rather helped direct and shape the research than

provide results. The case studied is presented in more detail in section 5.2 including the current IT infrastructure and the proposed IT infrastructure. In sections 5.3 and 5.4 the methods and processes for reaching the results are described and discussed.

Table 9: Summary of interviews

Interviews	Interview date	Subject
Provider 2 - cloud	16/11/2016	Background + TCO
Provider 1 - sales person	23/11/2016	Background
Provider 1 - tech	16/12/2016	Background + TCO
Provider 2 - cloud	02/03/2017	TCO
Provider 1 - tech	03/03/2017	TCO + CPSAM
Provider 2 - consultant	20/03/2017	CPSAM
Customer - project leader	25/04/2017	CPSAM

5.2 Case Definition

The case company is an expert and importer in the building service industry. They have been in the industry for nearly 60 years and their core competencies lie in the heating, ventilation and air-conditioning (HVAC) technologies. They work with Business-to-business sales and aim to provide complete HVAC solutions to their business customers. They recently launched a web shop for their HVAC products and are continuously developing their marketing and business strategy.

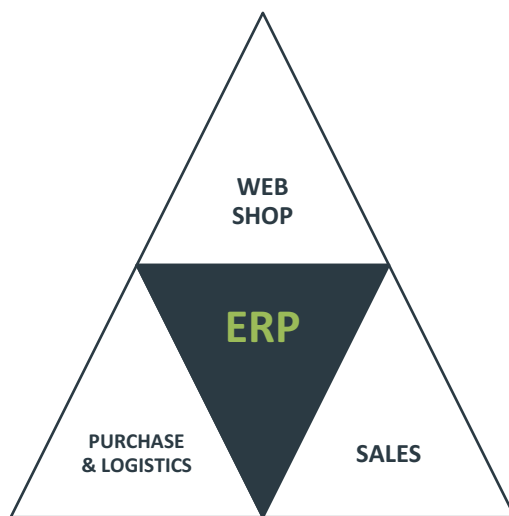


Figure 7: Business structure

The company employs around 30 people and their key competencies and responsibilities lie in sales, purchasing and administration. Therefore, most IT is outsourced. The current IT processes are built around the company's ERP system. This also includes the recently launched web shop which is built upon the ERP system. All business processes are also highly dependent on the ERP system which we can see in Figure 7. Due to the importance of the ERP system the company requires the proposed cloud scenario to synchronize with the current ERP software.

The company is currently trying to find a more cost-efficient IT architecture and more centralized IT management. This is illustrated in Figure 8. By centralizing IT management, the company hopes to decrease complexity, minimize risks within the internal processes and increase customer-provider alignment maturity.

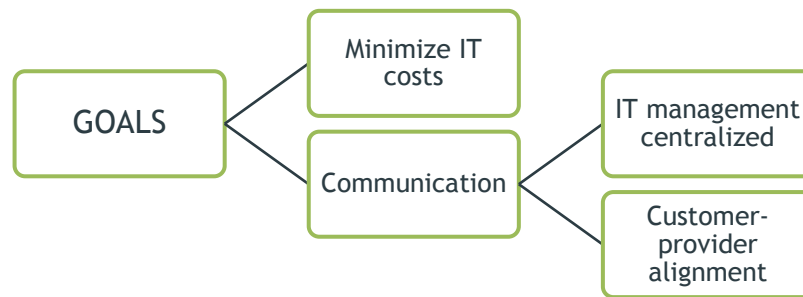


Figure 8: Goals

The current IT environment is built of multisourcing with external IT services and a summary of the providers and services outsourced can be viewed in Figure 9. Provider 1 provides the server solution and the hardware needed. The server solution consists of 10 virtual servers resulting in 12 CPU Cores and total memory allocation of 68 GB. A list of the current servers can be seen in Table 10. Provider 2 and its partners provide the ERP software, and the web shop solution. The IT environment is currently managed, maintained and monitored by the providers respectively. The main management, maintenance, and monitoring is done by provider 1 while software related management, maintenance, and monitoring falls under the responsibility of provider 2. Provider 1 makes on-site visits once a month and offers 24/7 email support.

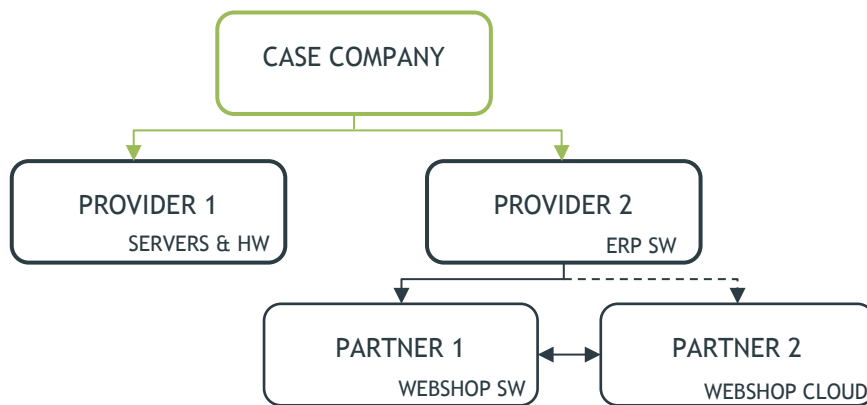


Figure 9: IT providers and partners, scenario 1

Table 10: Scenario 1 servers

Servers	type	
TEKNODC01	Domain controller	1 CPU
TEKNODC02	Domain controller	1 CPU
TEKNOMAIL01	Application server	1 CPU
TEKNOAPP01	Application server	1 CPU
TEKNONAV01	Application server	2 CPU
TEKNOSQL01	Application server	2 CPU
TEKNOWEB01	Application server	1 CPU
TEKNOTERM01	Application server	1 CPU
TEKNO-WEB	Application server	1 CPU
TEKNOSRV01		1 CPU

There is little communication between provider 1 and 2 which means that all communication is carried out via the case company. Consequently, the alignment does not only concern customer to provider alignment, it also includes the dilemma of provider to provider alignment. The main challenges of the current system are related to miscommunication and the performance of the IT system. The miscommunication is most apparent when system changes are made or troubles occur. The planning is done mostly separately with little inter-provider collaboration.

Scenario 2 represents a more centralized/converged IT outsourcing strategy. The IT environment is in this case migrated to an Azure cloud service offered by provider 2. Since

provider 2 already is providing the ERP software this would mean that all management, maintenance and monitoring would be brought under one roof. This means that in contrast to scenario 1 in this case the alignment dilemma focuses exclusively on customer to provider alignment. The other providers included in this scenario are currently partners of provider 2 and therefore their collaboration strategies are already in place. The outsourcing strategy of scenario 2 can be seen in Figure 10.

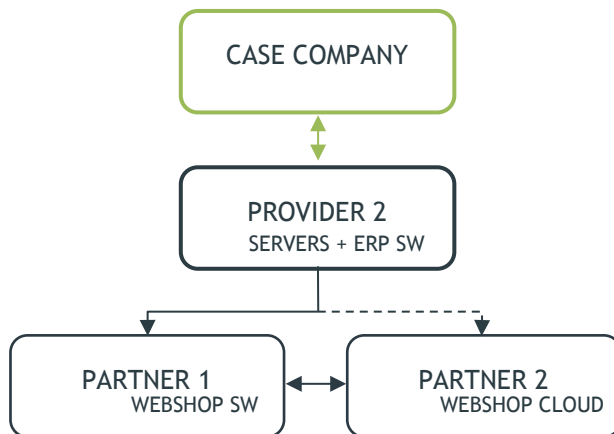


Figure 10: IT providers and partners, scenario 2

As mention provider 2 offers a Microsoft Azure cloud solution with an ongoing problem-solving service and access guarantee. As with other cloud solutions it offers flexibility meaning that the capacity can be changed based on need. The proposed server solution can be seen in Table 11. Scenario 2 also includes 24/7 support and ERP software maintenance.

Table 11: Scenario 2 servers

Servers	Type	
2 x D2v2		2 CPU, 7 GB (RAM), 100 GB disk space
1 x D3v2		4 CPU, 14 GB (RAM), 200 GB disk space
1 x D12v2	SQL	4 CPU, 28 GB (RAM), 200 GB disk space
1 x D3v2	NAV	4 CPU, 14 GB (RAM), 200 GB disk space

The migration process to the cloud includes planning of the Azure services and naturally the transition of the data to the cloud, this also contains planning and transition of the ERP system to the cloud. This scenario would also include the costs of decommission for scenario 1. The main challenges of migrating the IT environment to the cloud are related to planning and implementation and can include some downtime of a couple of weeks.

An important factor to consider when examining a cloud solution is the EU data reform, General Data Protection Regulation, which will take effect in May 2018. The GDPR presented in chapter 2.5 will affect both the cloud provider and its customers as all the organizations involved are liable for ensuring the protection of all personal data independent of location or transfer. The path to 100% GDPR compliance will not be easy, according to the Chief Privacy Officer of Microsoft [46], [47]. Nevertheless, Microsoft has committed to comply with the GDPR and to ensure that all their cloud services also comply with the regulation by May 2018 [46], [47].

It is important to remember that the provider does not bare all the responsibility of ensuring GDPR compliance. The case company must take responsibility in making sure data protection and privacy guidelines are followed and that all employees have the needed IT privacy training and knowledge. A common privacy and security issue faced by companies is Shadow IT. Shadow IT consists of all IT services that employees use for work without the employer's knowledge and that are not a part of the monitored IT. Shadow IT can for example include cloud services such as Dropbox or Google Drive used to share company files with personal cloud accounts. Shadow IT can be dangerous as it might lower the security level and increase chances of breach. Getting control over Shadow IT is especially important with the GDPR as a company not complying with the regulation can face fees up to 4% of their revenue. [48], [49]

The issue of complying with the GDPR concerns both scenarios. In scenario 1 there are two providers, in addition to the case company itself, with control of the case company's data. This means that identifying responsibilities and roles is more complex which in turn puts more responsibility on the case company to manage and control the overall compliance with the regulation. In scenario 2 on the other hand the roles are clearer making it easier to identify risk factors and the management of regulation compliance is more evenly shared between the case company and the provider.

5.3 Developing the TCO

The data used for the analysis of TCO in both scenarios was collected in collaboration with the providers. It is based on research done on current billing, information shared by the providers and on the discussions held with the providers.

As the case study can be described as both a process improvement and an outsourcing decision the approach chosen would either be dollar-based-direct costs or value-based costs. As mentioned in chapter 3, the dollar-based-direct cost focuses on gathering actual cost data for all relevant elements and then determining which elements to include based on their significance. The value-based approach on the other hand takes qualitative data and transforms it to quantitative data which means that elements that cannot be determined in terms of costs also can be incorporated.

In order to determine what cost data to gather a model was developed based on the literature in chapter 3. First the dollar-based approach was taken to get the direct costs of the current situation. The direct costs in these cases are implementation, operational, support, maintenance and enhancement costs. These are clearly defined in the contracts or can be determined based on billing history. The operational, support and maintenance costs have a $\pm 20\%$ margin of error as these can vary based on amount of support and maintenance needed from month to month. The billing history showed that the maintenance and support costs of provider 1 were mostly constant while the support and maintenance costs of provider 2 varied. The costs for scenario 2 were determined based on the server solution presented in Table 11. The continuous costs depend highly on chosen service level and monthly allocated maintenance hours and therefore can vary as in scenario 1. Hence a margin of error of $\pm 20\%$ will be assumed in this case as well. The enhancement costs are assumed to stay the same as they consist of the ERP license costs which will remain the same in the proposed scenario.

The decommission costs are not quite as straightforward to determine and the same approach cannot be taken to reach a result. Therefore, the value-based approach fits this part better. In scenario 1 where the collaboration with provider 1 is continued the decommission costs consist of updating to new servers as the old servers' lifetimes are ending. A typical time frame for server lifetime is 3-5 years, therefore it can be assumed that an update is inevitable in the following 3 years. Based on the discussions of VM migration costs, an update of servers would cost 5 500 – 7 000 €.

When it comes to decommission in terms of scenario 2 where the collaboration with provider 1 is ended, there are two alternative approaches. Either the virtual servers are bought and reclaimed for an agreed price or the files/data is transferred. The price of transferring the data is based on the amount of work required for the transition. The extra maintenance fee is 87€/h and based on the discussions with the providers the transition

could take up to 2 weeks. Based on the discussions and the estimated transition cost for scenario 2, a transition preparation time of 50h was assumed leading to a decommission cost of around 5 000 €.

Table 12: TCO preparation, scenario 1 & 2

TCO cost components	Scenario 1	Scenario 2
Cost to Implement (one-time costs)	55 863 € + virtual server implementation costs (Depreciated)	5 500 € + 7 000 € = 12 500 €
Cost to Operate, Support & Maintain (continuous costs)	4 039 €/month (supplier 1) + 3 080 €/month (supplier 2) = 7 119 €/month	3 343 €/month (support) + 2 000 €/month (maintenance) = 5 343 €/month
Enhancement Costs	11 800 €/year (ERP)	11 800 €/year (ERP)
Decommission Costs	Server updates (VM migration costs) 5 500 € - 7 000 € every 3-5 years	Decommission of provider 1 servers 50h x 87 €/h ≈ 5 000 €

An important part of TCO is to assess what cost data is essential and should be considered for the analysis. The original implementation costs for scenario 1 have been depreciated and will therefore not be considered in the analysis. As mentioned a common server lifetime used for TCO analysis is 3 years and consequently this will be used as a time frame in this analysis as well. Table 13 presents the total costs of both scenarios using the 3-year interval. The amount column presents the multiples used for each cost element to get the total costs for a 3-year interval. The one-time costs are multiplied by one as they only occur once whereas annual costs are multiplied by the number of years and monthly by number of years in addition to number of months in a year.

Table 13: TCO results, 3-year interval

TCO	Amount	Scenario 1	Scenario 2
Implementation Cost	1	Depreciated	12 500 €
Cost to Operate, Support & Maintain	3*12	256 284 €	192 348 €
Enhancement Cost	3	35 400 €	35 400 €
Decommission Cost	1	5 500 € – 7 000 € (VM migration)	5000 €
TOTAL	-	298 684 €	245 248 €

Based on the TCO results we can conclude that the main differences in costs derive from the operational costs (continuous costs). The implementation costs only have a small effect on the TCO and will presumably not form the deciding factor for the investment. Neither will the decommission costs as they are similar in both scenarios. The differences in operational costs is around 60 000 € over a 3-year period based on the TCO. As the operational costs are based on an estimate of the solution the cost sums may change, however if the 24/7 support cost is assumed to be constant, the maintenance costs compose the varying factor. Therefore, with a margin of error of $\pm 20\%$ the operational costs are still clearly lower in the second scenario.

5.4 Customer – Provider alignment

Maturity model theories presented in chapter 4 were used to map the current outsourcing collaborations and to get an overview of the current problem areas. First, a table for CPSAM components, practices and the related maturity levels was constructed based on the strategic alignment theory, and the table presented in Appendix A. The underlying structure of the table is the same and the tables share extensive similarities, however in order to get the perspective of outsourcing introduced, the CPSAM components and practices were incorporated. Furthermore, the SAM practices that did not match the CPSAM practices were removed. Also the maturity levels were adjusted according to the CPSAM theory presented in chapter 4.2. The resulting CPSAM table is presented in Appendix B.

Second, interview questions were prepared. As the interviews could not be recorded the most reasonable way to get extensive and somewhat honest answers was to conduct the interviews in a semi-structured manner with open questions. The questions were based on the CPSAM components and the goal of these interviews was to get insights into how each party views the collaboration and what expectations they have for the collaboration. The results should also point out differences in how the collaboration is viewed and what is expected. The interview questions were prepared in English and translated to and presented in Finnish for the providers (see Appendix C and Appendix D). Based on the interviews (see Appendix E), and with the aid of the CPSAM table, maturity levels for the different components were developed. These levels can be viewed in Table 14 together with the average maturity level of each component.

Table 14: CPSAM maturity levels

CPSAM	Provider 1	Provider 2	Customer	AVG
Value	3,0	2,5	2,5	2,7
Governance	3,0	3,0	3,0	3,0
Partnership	2,5	3,0	2,8	2,8
Communication	2,5	3,0	2,0	2,5
HR & Skills	3,0	2,5	2,3	2,6
Scope & Architecture	3,0	2,5	2,5	2,7

From Table 14 we can see that the overall customer-provider alignment maturity is best described as a weak level 3. Level 3 is described by Luftman and Gartner as established, focused and defined [4], [44]. Based on the results, processes are implemented and defined however the communication and articulation of the processes is lacking in improvement. Customer-provider planning is emerging, while roles and responsibilities remain unclear. The providers see their own roles quite clear, however their knowledge of the whole value network is limited. This also leads to metrics and service levels being more technical rather than also including strategic business goals. Problem resolution is at focus in the collaboration and there is ambiguity in vendor management and process approach.

As mentioned processes are emerging however they do not include the whole value network. The communication between the providers is little to non-existent, leading to confusion. The providers have good understanding of the customer and the customer's

needs, however the understanding of the whole value network including the other partners/providers seems lacking. Both providers stated that they have good insight into and control over their own projects with the client, however the projects orchestrated by the other partners are somewhat hidden and unclear. In terms of transparency, the providers document their own projects and processes however the documentation is rarely shared with the customer and the other provider has no insight. Documentation of the IT environment was prepared by provider 1 on demand of the customer. However, there is still need for documentation on the IT system in its entirety.

The dynamics of the relationship between the two providers is better described as competitors than partners. This is especially clear when problems occur and because of the dynamics between the providers the risks are much higher than if they were working together. Consequently, there has also been instances of mistrust in relation to both providers due to neither of the providers taking responsibility when problems occur. However, the providers believe that the customer trusts their judgment when it comes to technology solutions and that they can provide the best recommendations for the customer.

The Gartner vendor management model suggests recommendations on what should be improved to rise in maturity [44]. Because the results showed a weak maturity level of 3 the first steps should be directed at the areas that lower the overall score. We can see that the lowest score comes from the Communication component, however most other components also lower the score and should therefore also be considered in terms of improvements. According to recommendations by Gartner (see Table 8) provider management should be updated to include all providers and the process practices should be communicated across the entire organization. Regarding Governance and Partnership the contracts should be re-assessed for suitability to current developments and processes. This also includes assessing performance and comparing it to the SLAs and contracts. The external partners' roles and responsibilities should be defined in relation to each other and communicated across the value network.

Practices should be defined and standardized, particularly the communication practices between the providers and customer. This includes defining communication practices for problem-solving. Currently there are too many points of contact, leading to confusion when problems occur. Also as the providers are not currently working together as partners identifying which provider's responsibility, it is to solve the problem can at times turn out

to be time-consuming. Consequently, defining the communication practices is vital for the case company since their business is dependent on access to the ERP system and the whole IT architecture.

Based on discussions with the case company they are looking for a more transparent collaboration. As a result, they hope to gain increased control of the whole value network and minimize process risks. The focus of the collaboration should move to building long-term relations instead of solely focusing on problem-solving as it is more expensive in the long run. During the interviews, some discrepancy between the providers' and the case company's views on how the processes should be managed surfaced. In case of technical difficulties for example, the provider expects there to be someone on-site at the case company that can identify what the problem concerns and therefore who to contact. This however is problematic due to transparency issues and the case companies limited knowledge of the system in its entirety. Another related issue is that the case company experiences there to be too many people involved in the processes leading to unclear roles. They also experience there to be a gap between the sales team and the technology experts, indicating the need for a liaison with the knowledge of the whole value network. Consequently, the processes need to be defined and communicated to all parties.

The IT support offered by provider 1 is according to the case company an effective solution, however it does not cover the ERP system. Therefore, a similar support system should for efficiency be implemented with provider 2 as well as their current support practices are outdated. In terms of process planning it tends to be done separately with the providers respectively. Efforts should be put in joint planning and the focus move to together finding the best solution for the customer. For this to happen the providers need more transparency into each other's processes and practices to get the general picture of the collaboration.

6 Conclusions

The purpose of this case study was to study the current IT architecture versus a more centralized cloud based IT architecture both in terms of total cost of ownership and customer-provider strategic alignment maturity. The customer-provider strategic alignment maturity aided in identifying which areas that are currently causing issues and that could possibly be improved by changing outsourcing strategy. This chapter presents and discusses the results of the case study presented in the previous chapter.

6.1 Results

Based on the TCO analysis the differing factor of the scenarios are the operational costs. These consist of continuous costs such as maintenance and support. The operational costs are about 60 000 € lower in scenario 2 than in scenario 1 based on the TCO presented in Table 13. The one-time costs related to the implementation of scenario 2 are quite low and as the implementation costs of scenario 1 are depreciated the comparison of the two will not affect the investment decision. Neither will the enhancement costs and decommission costs as they are of the same level in both. As a conclusion, the significant costs of the TCO are operational rather than capital and depend on a series of factors.

What became evident in the CPSAM analysis is that the communication component decreases the maturity and is essential for the improvement of the collaboration. Further, the issues presented in the other components where linked to communication and showed noticeable need for articulation of processes and communication throughout the value network. The issues unveiled include lack of general picture, need for collaboration blueprint, communication practices and unclear roles and responsibilities.

The aim of this thesis was to address and analyse the benefits of a converged cloud solution for a small sized enterprise and to study cost efficiency and current issues. The TCO indicated that scenario 2 could generate savings in operational costs, therefore providing increased cost efficiency in relation to scenario 1. In terms of CPSAM, the vendor management needs a decrease in complexity and the responsibility should be shared more evenly between the provider and the customer. Therefore, a simpler collaboration structure, as presented in scenario 2, might provide some clarity and ease. However, many of the issues unveiled by the CPSAM concern both scenarios, and improvement efforts in

these areas are essential independent of chosen scenario. Some processes are still lacking in improvement in scenario 2 regarding communication and understanding of the whole value network.

6.2 Assessment of results

When it comes to case studies one cannot claim that a single case is a general representation and representative of other cases [45]. Therefore, the findings of this case study can only be assumed to represent this case. If a pattern or typical result is sought several cases would have to be studied.

As the case company's IT infrastructure is built with the help of several providers the TCO data proved difficult to gather. The costs were gathered through reviewing contract and invoice research and based on discussions with the providers. As some of the costs are difficult to quantify and define, the result of the cost analysis might not be exact, however it should be able to provide direction and help derive recommendations. The hidden costs consist of costs such as extra fees and premium support and are therefore difficult to assess. To balance the variability of the hidden costs a margin of error of $\pm 20\%$ is assumed.

An essential part of the TCO is assessing what cost data is essential for the analysis and what should be focused on. Due to the limited knowledge of the cost structures and the limited access to cost data, the analysis was slightly restricted. The point of TCO analysis is considering all costs and then restricting it to the most significant costs. This was completed to the best ability.

The information gathered based on the discussions with the providers can be unreliable in certain terms as their responses were nuanced and subjective. This can influence the results and should be taken into consideration when conducting the analysis. Also, the nature of semi-structure qualitative interviews allows for the interpretation of the interviewer, meaning that the results can be affected by the interviewers understanding of the answers. However, most of the CPSAM issues came up during several interviews reinforcing the credibility of the results.

6.3 Exploitation of results

As presented in 6.1 the main difference of scenarios in TCO derive from the operational costs. These consist of the maintenance and support costs and depend on chosen support

plan. The operational costs can vary as they partly consist of hidden costs such as premium support and extra fees for exceeding usage. In terms of TCO the operational costs show clear benefits of implementing scenario 2 however, if the company decides to pursue scenario 2 they should investigate the operational costs further to determine what level of support and maintenance is most cost efficient. This will be discussed further in the following subchapter.

As stated in 6.1 the main issues are related to the communication domain. To increase in maturity and therefore strengthen the provider relations independent of chosen scenario efforts need to be put in certain areas. These include, articulation of communication processes and communicating these across the whole value network, construction of a blueprint for the collaboration, and re-assessing the current contracts for suitability with current demands and developments. The collaboration blueprint should include clear description of roles and responsibilities and definition of communication practices. These are both vital as they provide a good basis for quick problem-solving, accessibility and minimization of risks. For the overall knowledge and awareness of the whole value network to improve efforts should be put in enhancing transparency.

An issue that surfaced during the interviews in relation to communication is that the case company wishes for a similar 24/7 support system on the software side that provider 1 is currently providing. This is apparently part of the scenario 2 solution offered by provider 2 which would mean that they already have 24/7 support plans to offer. Therefore, a new support plan could be negotiable in scenario 1 in case it is decided to continue with the current IT ecosystem. As mentioned in chapter 5, the billing history showed that the maintenance and support costs of provider 1 were mostly constant while the same costs of provider 2 varied. Based on this it could be assumed that the support plan offered by provider 1 meets the needs of the case company quite well whereas the support fees paid for provider 2's services include some hidden costs.

It can be concluded that independent of chosen scenario the data privacy and protection should be a priority and clear guidelines for how to ensure compliance with the GDPR must be drawn both across the enterprise and with the providers. This includes assuring that there is a liaison at every single organization involved in the value network that is responsible for ensuring compliance and notification of data breaches. As mentioned in chapter 5, GDPR compliance would in scenario 2 be easier for the company to manage as the responsibility is more evenly shared between the provider and the case company. In

scenario 1 the case company has more responsibility as there are two providers involved and the risks are more complex.

6.4 Future research

As mentioned in the previous subchapter the operational costs should be investigated further to assess most suitable support plan, thereby minimizing hidden costs. This could be done based on their demand history, i.e. studying how many hours per month on average the case company requires maintenance and extra support and choosing the most suitable plan to meet their needs. When the plan is chosen the estimated costs for that solution can then be compared to the TCO's presented in 5.3 in order to get a general picture of the differences between the scenarios and to help make an informed decision.

Another aspect that should be further investigated is the acquisition of extra hardware products, such as laptops and mobile phones, currently provided by provider 1. It should be explored whether these could be purchased through provider 2 in the second scenario and what the cost levels in this case would be compared to scenario 1. When considering future costs an important aspect of cloud computing discussed in chapter 2 are negative aspects such as lock-in or switching costs which consist of the costs of switching providers in the future. These will naturally affect the TCO of scenario 2 and should be investigated.

On a more general note the CPSAM framework could be developed into a study on how to better align two or more providers in their collaboration with each other. That is, investigating alignment of provider partnership moving from less mature relationship, providers acting as competitors, to more mature relationship where they act as partners providing the customer with a mutual solution. Even though an inter-provider relationship was not directly studied in this case, the results indicate that the CPSAM could be adopted for this purpose as well.

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Appendices

Appendix A – SAM table

Appendix B – CPSAM table

Appendix C – Interview questions in Finnish

Appendix D – Interview questions in English

Appendix E – Summary of interview notes

Appendix A – SAM table

Practice Categories	Practices	Level 1: With Process (No Alignment)	Level 2: Beginning Process	Level 3: Established Process	Level 4: Improved Process	Level 5: Optimal Process (Complete Alignment)
Communications	Understanding of Business by IT	IT management lacks understanding	Limited understanding by IT management	Good understanding by IT management	Understanding encouraged among IT staff	Understanding required of all IT staff
	Organizational Learning	Managers lack understanding	Limited understanding by managers	Good understanding by managers	Understanding encouraged among staff	Understanding required of staff
	Style and Ease of Access	Casual conversations and meetings	Newsletters, reports group e-mail	Training, departmental meetings	Formal methods sponsored by senior management	Learning monitored for effectiveness
	Leveraging Intellectual Assets	Business to IT only; formal	One-way, somewhat informal	Two-way, formal	Two-way, somewhat informal	Two-way, informal and flexible
	IT-Business Liaison Staff	Ad hoc	Some structured sharing emerging	Structured around key processes	Formal sharing at all levels	Formal sharing with partners
Competency/Value Measurements	IT metrics	None or use only as needed	Primary IT-business link	Facilitate knowledge transfer	Facilitate relationship building	Building relationship with partners
	Business Metrics	Technical only	Technical cost; metrics rarely reviewed	Review, act on technical, ROI metrics	Also measure effectiveness	Also measure business ops, HR, partners
	Link between IT and Business Metrics	IT investments measured rarely, if ever	Cost/unit rarely reviewed	Review, act on ROI, cost	Also measure customer value	Balanced scorecard, includes partners
	Service Level Agreements	Value of IT investments rarely measured	Business, IT metrics not linked	Business, IT metrics becoming linked	Formally linked; reviewed and acted upon	Balanced scorecard, includes partners
	Benchmarking	Use sporadically	With units for technology performance	With units; becoming enterprise wide	Enterprise wide	Includes partners
Governance	Formally Assess IT Investments	Seldom or never	Sometimes benchmark informally	May benchmark formally; seldom act	Routinely benchmark, usually act	Routinely benchmark, act on, and measure results
	Continuous Improvement Practices	Do not assess	Only when there is a problem	Becoming a routine occurrence	routinely assess and act on findings	Routinely assess, act on, and measure results
	Formal Business Strategy Planning	None	Few; effectiveness not measured	Few; starting to measure effectiveness	Many; Frequently measure effectiveness	Practices and measures well-established
	Formal IT Strategy Planning	Not done, or done as needed	At unit functional level, slight IT input	Some IT input and cross-functional planning	At unit and enterprise, with IT	With IT and partners
	Organizational Structure	Not done, or done as needed	At unit functional level, light business input	Some business input and cross-functional planning	At unit and enterprise, with business	With partners
	Reporting Relationships	Centralized or decentralized	Central/decentral; some collocation	Central/decentral or Federal	Federal	Federal
	How IT is Budgeted	CIO reports to CFO	CIO reports to CFO	CIO reports to COO	CIO reports to COO or CEO	CIO reports to CEO
	Rational for IT Spending	Cost center, spending is unpredictable	Cost center by unit	Some projects treated as investments	IT treated as investment	Profit center
	Senior-Level IT Steering Committee	Reduce costs	Productivity, efficiency	Also a process enabler	Process driver, strategy enabler	Competitive advantage, profit
	How Projects are Prioritized	Do not have	Meet informally as needed	Formal committees meet regularly	Proven to be effective	Also includes external partners
		React to business or IT need	Determined by IT function	Determined by business function	Manually determined	Partners' priorities are considered

Partnership	Business Perception of IT	Cost of doing business	Becoming an asset	Enables future business activity	Drives future business activity	Partner with business in creating value
	IT's role in strategic business planning	Not involved	Enables business processes	Drives business processes	Enables or drives business strategy	IT, business adapt quickly to change
	Shared Risks and Rewards	IT takes all the risks, receives no rewards	IT takes most risks with little reward	IT, business start sharing risks, rewards	Risks, rewards are shared	Managers incented to take risks
	Managing the IT-Business Relationship	IT-business relationship is not managed	Managed on an ad hoc basis	Processes exist but not always followed	Processes exist and complied with	Processes are continuously improved
	Relationship/Trust Style	Conflier and mistrust	Transactional relationship	IT becoming a valued service provider	Long-term partnership	Partner, trusted vendor or IT services
Technology Scope	Business Sponsors/Champions	Usually none	Often have a senior IT sponsor or champion	IT and business sponsor or champion at unit level	Business sponsor or champion at corporate level	CEO is the business sponsor or champion
	Primary Systems	Cost of doing business	Becoming an asset	Enables future business activity	Drives future business activity	Partner with business in creating value
	Standards	Not involved	Enables business processes	Drives business processes	Enables or drives business strategy	IT, business adapt quickly to change
	Architectural Integration	IT takes all the risks, receives no rewards	IT takes most risks with little reward	IT, business start sharing risks, rewards	Risks, rewards are always shared	Managers incented to take risks
	How IT Infrastructure is Perceived	IT-business relationship is not managed	Managed on an ad hoc basis	Processes exist but not always followed	Processes exist and complied with	Processes are continuously improved
Skills	Innovative, Entrepreneurial Environment	Discouraged	Somewhat encouraged at unit level	Strongly encouraged at unit level	Also at corporate level	Also with partners
	Key IT HR Decisions Made by:	Top business and IT management at corporate	Same, with emerging functional influence	Top business and unit management; IT advisors	Top business and IT management across firm	Top management across firm and partners
	Change Readiness	Tend to resist change	Change readiness programs emerging	Programs in place at functional level	Programs in place at corporate level	Also proactive and anticipate change
	Career Crossover Opportunities	Job transfers rarely occur	Occasionally occur within unit	Regularly occur for unit management	Regularly occur at all unit levels	Also at corporate level
	Cross-Functional Training and Job Rotation	No opportunities	Decided by units	Formal programs run by all units	Also across enterprise	Also with partners
	Social Interaction	Minimal IT-business interaction	Strictly a business-only relationship	Trust and confidence is starting	Trust and confidence achieved	Attained with customers and partners
	Attract and Retain Top Talent	No retention program; poor recruiting	IT hiring focused on technical skills	Technology and business focus; retention program	Formal program for hiring and retaining	Effective program for hiring and retaining

Appendix B – CPSAM table

	CPSAM components	Level 1: Initial/ad hoc	Level 2: Repeatable/ Committed	Level 3: Defined	Level 4: Managed	Level 5: Optimized
Value	Customer and Provider Metrics (tech. and bus.) for services	Technical based only	Technical and cost-oriented. Not linked to other value measurements	Review, act on technical, ROI metrics	Also measure effectiveness	Also measure business ops, HR, partners
	SLA and Management Process	Use sporadically	With units for technology performance	With units; becoming enterprise-wide	reflect enterprise-wide customer goals	also includes partners
	Benchmarks	Seldom or never	Sometimes benchmark informally	May benchmark formally, seldom act	Routinely benchmark, usually act	Routinely benchmark, act on, and measure results
	Formal Assessments	Do not assess	Only when there is a problem	Becoming a routine occurrence	routinely assess and act on findings	Routinely assess, act on, and measure results
	Improvement Reviews	None	Few; effectiveness not measured	Few; starting to measure effectiveness	Many; Frequently measure effectiveness	Practices and measures well-established
Governance	Statutory and Regulatory Requirements	No formal structure. Difficulties with crises and making commitments	Planning based on previous experience. Ad hoc problem and demand management	Some IT input and cross-functional planning. Demand patterns are analyzed.	Contract management is more agile and includes renegotiation. Demand management based on projections	Oversight structure extended to customer partners. Continuous adjustments of contracts and services.
	Formal/Informal Mechanisms	Formal and rigid relationship. Contract based.	Transaction-based interaction.	Some customer-provider planning emerging.	Formal governance and strategic planning is integrated.	Meticulous governance structures and informal interactions
	Resource Allocation Process	Cost center, spending is unpredictable. Investment rational: Reduce costs	Cost center by unit. Investment rational: increase productivity and efficiency	Some projects treated as investments. Investment rational: process enabler	IT treated as investment. Investment rational: process driver, strategy enabler	Profit center. Investment rational: competitive advantage, profit
	Use of Joint Strategic, Tactical and Operational Committees	Do not have	Ad hoc informal meetings	Formal committees emerging and meeting regularly	Formal committees meet regularly	Also includes external partners
	Prioritization Process	React to business or IT need	Technical skills of provider decide engagement.	Engagement prioritization reacts to "loudest voice"	Manually determined	Partners' priorities are considered
Partnership	Role of Provider in Customer Strategy and Planning	No integrated customer-provider strategy. Customer and Provider "at arm's length".	Enables customer processes. Some alignment.	tends to be done separately, some shared planning has emerged	Strategic planning is integrated. Enables or drives customer strategy.	Integrated planning. Provider, customer adapt quickly to change. (co-adaptive)
	Shared Goals, Risks, Rewards/Penalties	IT takes all the risks, receives no rewards	IT takes most risks with little reward	Customer more willing to outsource risk, and engage in risk-sharing with provider	Risks, rewards are shared	Managers incented to take risks
	Formal and Informal Agreements	Formal and rigid relationship. Contract based.	Managed on an ad hoc basis	Processes exist but not always followed	Processes exist and complied with	Processes are continuously improved
	Mutual Trust	Conflict and minimal trust	Transactional relationship	Provider increasingly viewed as a valued asset	Value co-producers. Long-term partnership	Trusted relationship between customer and provider reinforced continuously.
	Joint Sponsor and Champions	Usually none	Often have a senior IT sponsor or champion	engagement managers, executives, sponsors, & champions	Business sponsor or champion at corporate level	CEO is the business sponsor or champion

Communications	Customer Understanding of Provider	Poor understanding of value or contribution provided	Limited understanding of roles and responsibilities	understanding is emerging	increased understanding, Closed service gap	Understanding required of all Customer staff
	Provider Understanding of Customer	Poor understanding of value or contribution provided	Limited understanding of roles and responsibilities	key stakeholders understand the customer	increased understanding, Closed service gap	Understanding extended to customer's value chains
	Organizational Learning and Knowledge Sharing	Poor communications between customer and provider	limited investment in relationship development	Training, departmental meetings	Formal methods sponsored by senior management	new knowledge is frequently shared
	Customer-Provider Liaison	None or use only as needed	Primary Customer-Provider link	Facilitate knowledge transfer	Facilitate relationship building	Building relationship with partners
HR & Skills	Technical and Business Skills of Customer and Provider	Basic technology focus	Technical skills of provider at focus	Balance of business & technical skills	Strong technical & business understanding and knowledge sharing	Focus on continuous improvement
	Change Readiness	Tend to resist change	Change readiness programs emerging	Programs in place at functional level	Programs in place at corporate level	Also proactive and anticipate change
	Cross Training/Education	Little to no HR information and training shared	some education/training is shared	Education/training shared and people resource pooling occurs	Seen as efficient long-term mechanisms for harmony	Also with partners
	Cultural Match	Minimal IT-business interaction	Strictly a business-only relationship	Trust and confidence is starting	Trust and confidence achieved	Attained with customers and partners
Scope and Architecture	Hiring/Retaining; Skills Management and Portfolio	No retention program; poor recruiting	IT hiring focused on technical skills	Technology and business focus; retention program	Formal program for hiring and retaining	Effective program for hiring and retaining
	Standards (Adherence)	Not involved	Enables business processes	Drives business processes	Enables or drives business strategy	processes integrate strategic business planning and provider planning
	Architectural Agility, Transparency, Flexibility	IT takes all the risks, receives no rewards	IT takes most risks with little reward	Customer and provider start sharing risks and rewards	Risks, rewards are always shared	Managers incented to take risks
	Impact of Provider Services on Customer and its Partners	Traditional operational/back office support	perceived value relates to basic operations	Provider influence emerging	Provider influence achieved and demonstrated	Provider influence extended to customer's partners

Appendix C – Interview questions in Finnish

1. Miten hyvin yhteistyö projektit/prosessit on dokumentoitu ja hallittu?
2. Ovatko asiakkaan tarpeet ja vaatimukset selkeästi määritelty?
3. Miten projektit suunnitellaan? Kuka osallistuu suunnittelu vaiheeseen?
4. Miten kuvailisitte roolinne yhteistyössä?
5. Luottaako asiakas teidän mielestä teihin?
6. Miten jaatte tietoa asiakkaan kanssa?
7. Löytyykö tietty henkilö, joka ensisijaisesti toimii yhteyshenkilönä asiakkaalle ja millainen rooli tällä henkilöllä on? Miten kuvailisit linkin rooli
8. Millaiset resurssit näette, että tuotte yhteistyölle? Teknisesti/liiketoiminnallisesti
9. Miten paljon vaikutusvaltaa teillä on?
10. Miten kuvailisitte täydellinen yhteistyö tai mitä teidän mielestänne pitäisi muuttaa, jotta yhteistyö olisi sulavampaa?

Appendix D – Interview questions in English

1. How well is the collaboration structure documented and managed?
2. Are the service metrics and needs and requirements of the customer well defined?
3. How are the projects planned? Who takes part in the planning?
4. How would you describe your role in the collaboration?
5. Do you feel that the customer trusts your judgement?
6. How do you share information with the customer?
7. Is there a liaison? What role does the link/liaison have?
8. What skills/resources do you bring to the collaboration? Technical/business
9. How much influence do you feel you have on the projects/collaboration?
10. How would you describe a perfect collaboration and what should change to get there?

Appendix E – Summary of interview notes

	Provider 1	Provider 2	Customer
Documentation and project/process management:	<ul style="list-style-type: none"> IT environment is documented and shared with customer Project planning is conducted and maintained Own projects are documented thoroughly <ul style="list-style-type: none"> No insight into the other partners projects Only knowledge of own projects 	<ul style="list-style-type: none"> Knowledge of the general picture is important for documentation Okay documentation 	<ul style="list-style-type: none"> Internal documentation at providers is probably good but is rarely communicated to the customer Little or non-existent collaboration/communication between provider 1 and 2 No clear blueprint of how the cooperation should work Provider 1 takes care of infrastructure Provider 2 takes care of software
Needs & requirements	<ul style="list-style-type: none"> Was probably done in the beginning <ul style="list-style-type: none"> May have not been regulated since the beginning. The current needs might be a little outdated A new role has been introduced in order to fix the situation and redefine the relationship 	<ul style="list-style-type: none"> Much effort is put in on this part Everything is tested and discussed with the customer 	<ul style="list-style-type: none"> The needs and requirements should be clear as they have been constant for some time
Project planning	<ul style="list-style-type: none"> In collaboration with the customer Guidelines If it concerns the ERP then provider 2 also takes part in the planning 	<ul style="list-style-type: none"> Documentation of solution parts. Uncertain role structures during project planning Consultant as main project driver 	<ul style="list-style-type: none"> Too many people involved when it comes to provider 2 Too many contact surfaces. There is a clear gap between sales and tech Gap between different departments at provider Customer seeks for more solution based conversation vs current “sales, sales, sales” Someone with the general picture needed as contact person The sales person should also understand the overall picture
Role	<ul style="list-style-type: none"> Not quite a cooperation/collaboration partner Service provider View of whole missing, awareness/information missing <ul style="list-style-type: none"> Seek closer collaboration 		<ul style="list-style-type: none"> Represent the end-product Paying customer Defines the needs and build together with the providers a working solution to meet these needs
Trust	<ul style="list-style-type: none"> Could be better 	<ul style="list-style-type: none"> Reasonable trust An atmosphere of mistrust before 	<ul style="list-style-type: none"> The trust is tied to certain people The providers trust that the customer knows its own processes and needs. They might perceive the customer's general picture vague
Information/Knowledge sharing	<ul style="list-style-type: none"> Meetings Sales Support & on-site visits Bills Etc. 	<ul style="list-style-type: none"> Email and tel Documentation on usage (logs) 	<ul style="list-style-type: none"> Service document hotel, development data for NAV Email and tel On-site support once a month Remote support is a well working system, should be adopted by provider 2 also Provider 2's support system seems out dated
Link	<ul style="list-style-type: none"> Depends on the reason of contact Support station best first contact, can judge whether concerns sales or tech 	<ul style="list-style-type: none"> There are two different links at the customer side, taskmaster and steering committee member At the provider the coordinator acts as the first point of contact and the consultant handles more complex issues 	<ul style="list-style-type: none"> Sales and support Coordinator first and consultant when matter concerns more complex issues
Resources	<ul style="list-style-type: none"> Full/Whole IT field/base Enables business stability 	<ul style="list-style-type: none"> Opportunity to support the whole business Vague clarity in differences between roles and responsibilities of provider 1 vs provider 2 → Pressure on the customer 	<ul style="list-style-type: none"> View and knowledge of the whole process Experts in using the ERP
Influence	<ul style="list-style-type: none"> The customer (case company) trusts that 	<ul style="list-style-type: none"> Understanding of the needs and requirements of the customer → 	<ul style="list-style-type: none"> Project leader and directs the cooperation

	provider 1 can provide the best solution	the customer respects our expertise and listens to our suggestions	
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